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Cardiogenic shock: old and new circulatory assist devices: the role of counter-pulsation

Giovanna Viola, Nuccia Morici, Alice Sacco, Miriam Stucchi, Dario Brunelli, Manlio Cipriani, Andrea Garascia, Maurizio Bottiroli, Maria Frigerio, and Fabrizio Oliva

De Gasperis Cardio Center, ASST Grande Ospedale Metropolitano Niguarda, Milano, Italia

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Cardiogenic shock (CS) is a clinical condition still burdened with high mortality notwithstanding the advances in invasive and pharmacologic therapies. Apart from the well-established favourable prognostic impact of coronary revascularization for patients with CS after acute myocardial infarction, other 'reference standards' for treatment are lacking. The appropriate management of patients in CS is contingent on the underlying condition. Nonetheless, beside the condition behind the systolic or diastolic left ventricular dysfunction leading to inadequate oxygen delivery, the timely implementation of ventricular *unloading*, by improving peripheral perfusion and decreasing filling pressures, is an important tool to prevent irreversible organ damage. Present evidence downgraded intra-aortic balloon pump (IABP) as an effective tool for *unloading* patients with CS. This feedback is based on a single trial, addressing patients with acute coronary syndrome. In our centre, IABP has been utilized as an essential device for patients with acutely decompensated heart failure.

We retrospectively revised data from patients admitted to the Cardiac Intensive Care Unit at the ASST Grande Ospedale Metropolitano Niguarda Ca' Grande of Milan, during the period September 2014–December 2016. The diagnosis of CS was based on the criteria outlined by the Guidelines of the European Society of Cardiology (ESC): systolic blood pressure $<$90 mmHg or mean arterial pressure $<$60 mmHg, signs of increased central venous pressure ($>$12 mmHg), mental confusion, clammy and cold skin, mixed venous oxygen saturation $<$60%, arterial lactate $>$2 mmol/L, oliguria $<$0.5 mL/kg/h, and hepatorenal organ damage.

Many studies regarding CS address an assorted patients' population with high prevalence of ischaemic cardiomyopathy and are still reporting unsatisfactory results. Our data suggest that early and integrated management of patients with acute heart failure, relying on a stepwise use of pharmacologic and mechanical circulatory support, could be useful, in view of the 30 days survival achieved (86%). Despite the negative results reported by some trials and the downgrading by the current Guidelines, IABP could be considered a useful tool in a selected group of patients, as a bridge-to-recovery or as an intermediate step towards more advanced ventricular support or cardiac transplantation.[1] Its action should be understood as a mean to decrease left ventricular afterload, while at the same time improving coronary perfusion without increasing oxygen demand or the risk of hyperkinetic arrhythmias, as with high doses pharmacologic inotropic support. This observation is supported by the distinct improvement trend observed by comparing data in our patients, before, after 48 h of IABP support, and at the time of the device removal, in terms of haemodynamic stabilization. Haemodynamic improvement is quick to occur in terms of mean arterial pressure, heart rate, central venous pressure, and hourly urine output (P trend $<$0.001). On the other hand, more invasive and expansive technologies (ECMO and Impella left ventricular assistance), at present, do not have supportive data recommending their use as the first step, over aortic counterpulsation in terms of both efficacy and safety.[2,3] Analysing the trends of the laboratory parameters, our population did not present, at the onset, signs of organ damage, even though there was a decreased urine output, and slight liver damage, all improving, as well as the values of urea, creatinine, urine output, and bilirubin at 48 h and at the time of the device removal. The inference is that by recognizing early signs of peripheral hypoperfusion,

optimal timing for circulatory support could be established, thus preventing irreversible multiorgan dysfunction, which is the cause of the ominous prognosis in this setting.

Finally, from the safety perspective, the data show that in high volume centres with significant expertise, IABP related complications are limited (<4%), making the device simple to insert (also at bed side and without fluoroscopy), and with a rate of local or systemic thrombotic complications very low. Furthermore, the device can be used for extended periods of time, and the new balloons do not require continuous heparin infusion, significantly lowering the risk of bleeding.

Our data suggest that IABP could be a valid first line mechanical circulatory support both in terms of 'bridge to decision' and as a guide to vasoactive pharmacologic treatment, thus improving the 30 days outcome of these patients.

Conflict of interest: none declared.

References

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